

Application No. 10/087,566

REMARKS

Claims 25-72 are pending.

Rejections Under 35 U.S.C. § 102

Claims 25 and 36 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Publication No. 2001/0017770 to Copetti et al. (hereinafter Copetti). This rejection is respectfully traversed.

Claim 25 recites an insulating substrate board for a semiconductor comprising a ceramic substrate board and a metal alloy layer consisting mainly of aluminum bonded by direct bonding on at least one surface portion of the ceramic substrate board, wherein the Vickers hardness of the metal alloy layer is not less than 25 and not more than 40. Copetti does not teach or suggest that the Vickers hardness of the metal alloy layer is not less than 25 and not more than 40.

As stated in the Amendment filed January 26, 2004, the Vickers hardness of an alloy or material may vary according to the process of hardening even if the compositions are the same. According to the present invention, the reliability of the claimed structure, for example with regard to preventing cracks from forming in the brazing material and in the ceramics, can be enhanced and improved by direct bonding of a metal alloy layer to a ceramic substrate board, wherein the Vickers hardness of the metal alloy layer is not less than 25 and not more than 40.

Submitted herewith as evidence that a Vickers hardness may vary according to a process of hardening a material are two references. Refer to MPEP § 609(III)(C)(3). Copies of the relevant portions of each reference in the original Japanese, along with English translations of the tables referred to below, are appended hereto as Attachment 1 and Attachment 2. The first reference from Keikin-zoku Gakai is entitled "The Structure and Quality of Aluminum," November 30, 1991 (Attachment 1). In particular, Table 1 on page 413 of this reference shows

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various chemical compositions, and Table 4.1 on page 413 shows the standard mechanical quality of the alloy at room temperature. Table 2.4 on page 368 of a reference from Jippon Kinzoku Gakai entitled "The Metal Data Book," January 30, 1984 (Attachment 2), shows conversions between Vickers hardnesses and Brinell hardnesses. Referring to Table 4.1, three hardening processes are shown, each resulting in a different Brinell hardness. Considering Tables 2.4 and 4.1, the Vickers hardness may also vary according to the hardening process. Therefore, the Vickers hardness of a material may vary according to either or both a composition of the material and a process of hardening the material.

Copetti does not teach or suggest a ceramic substrate board and a metal alloy layer consisting mainly of aluminum bonded by direct bonding on at least one surface portion of the ceramic substrate board, wherein the Vickers hardness of the metal alloy layer is not less than 25 and not more than 40, as recited in claim 25. Accordingly, Applicant respectfully requests that the rejection of claims 26 and 36, claim 36 depending from claim 25, under 35 U.S.C. § 102(e) as being anticipated by Copetti be withdrawn.

Rejections Under 35 U.S.C. § 103

Claims 25-28, 30-32, 35, and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,965,193 to Ning et al. (hereinafter Ning) in view of U.S. Patent No. 4,222,774 to Boutin et al. (hereinafter Boutin). Claims 29, 33, and 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ning and Boutin, and further in view of U.S. Patent No. 6,153,025 to Auran et al (hereinafter Auran). Claims 49-52, 54-56, and 59-60 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,297,549 to Hiyoshi (hereinafter Hiyoshi) in view of Ning and Boutin. Claims 53, 57, and 58 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hiyoshi, Ning, and Boutin, and further in view of Auran. Claims 37-40, 42-44, 47, 48, 61-68, 71, and 72 stand rejected under 35 U.S.C. §

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103(a) as being unpatentable over U.S. Patent No. 6,122,170 to Hirose et al. (hereinafter Hirose) in view of Boutin. Claims 41, 45, 46, 65, 69, and 70 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hirose and Boutin and further in view of Auran. These rejections are respectfully traversed.

The cited references of Ning, Boutin, Auran, Hiyoshi, and Hirose, alone or in combination, neither teach nor suggest an insulating substrate board for a semiconductor comprising a ceramic substrate board and a metal alloy layer consisting mainly of aluminum bonded by direct bonding on at least one surface portion of the ceramic substrate board, wherein the Vickers hardness of the metal alloy layer is not less than 25 and not more than 40, as recited in claim 25. The cited references are silent as to Vickers hardness, in particular a Vickers hardness of a metal alloy layer of not less than 25 and not more than 40 in combination with the other recited elements of the claim.

Therefore, claim 25 is allowable. Claims 26-36 depend from claim 25 and are allowable at least for the reasons set forth above.

Claim 37 recites an insulating substrate board for a semiconductor comprising a ceramic substrate board and a metal alloy layer consisting mainly of aluminum bonded through a brazing material layer on at least one surface portion of the ceramic substrate board, wherein the Vickers hardness of the metal alloy layer is not less than 25 and not more than 40. Claim 49 recites a power module comprising a ceramic substrate board, metal alloy layers consisting mainly of aluminum bonded by direct bonding on both surfaces of the ceramic substrate board, a metal base plate bonded to one of the metal alloy layers, and a semiconductor tip formed on the other of the metal alloy layers, wherein the Vickers hardness of at least said one alloy layer is not less than 25 and not more than 40. Claim 61 recites a power module comprising a ceramic substrate board, metal alloy layers consisting mainly of aluminum bonded through a brazing material on both surfaces of the ceramic substrate board, a metal base plate bonded to one of the

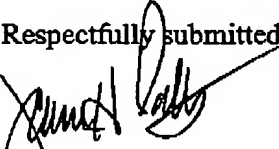
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metal alloy layers, and a semiconductor tip formed on one of the metal alloy layers, wherein the Vickers hardness of at least said one metal alloy layer is not less than 25 and not more than 40. At least for reasons similar to those set forth above with respect to claim 25, claims 37, 49, and 61 are allowable. Claims 38-48, 50-60, and 62-72 variously depend from claims 37, 49, and 61 and are therefore also allowable at least for these reasons.

In view of the foregoing, it is submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

The Examiner is invited to telephone the undersigned if the Examiner believes it would be useful to advance prosecution.

Respectfully submitted,


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